IN THE CLAIMS:

Claims 1, 6, 10, 11, 28, 30, 41, 44, 46 and 48 have been amended herein. Please note that all claims currently pending and under consideration in the referenced application are shown below, in clean form, for clarity. Please enter these claims as amended. Also attached is a version with markings to show changes made to the claims.

1. (Amended) A method of removing motion artifacts from electrical signals representative of attenuated light signals, comprising:

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transforming the electrical signals into frequency domain data;

identifying a plurality of candidate peaks from said frequency domain data, wherein said identifying includes eliminating harmonic frequencies as possible candidate peaks to obtain a plurality of identified candidate peaks, wherein no two of said plurality of identified candidate peaks comprise harmonics of one another;

developing parameters associated with each of said plurality of identified candidate peaks;

analyzing each of said plurality of candidate peaks with respect to at least some of said developed parameters; and

arbitrating between at least some of said plurality of candidate peaks employing at least some of said developed parameters to select a best frequency.

2. The method of claim 1, further comprising conditioning said electrical signals to reduce spectral leakage prior to said transforming step.

3. The method of claim 2, wherein said conditioning includes filtering said electrical signals.

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4. The method of claim 3, wherein said filtering is performed with a Hanning window.

5. The method of claim 1, wherein said transforming the electrical signals into frequency domain data is performed with a fast Fourier transform.

6. (Amended) The method of claim 1, wherein said transforming the electrical signals into frequency domain data is performed with a technique selected from the group consisting of a periodogram, a correlogram, autoregressive methods, Prony's method, minimum variance methods, maximum likelihood methods, a discrete cosine transform, a wavelet transform, a discrete Hartley transform and a Gabor transform.

7. The method of claim 1, wherein said identifying said plurality of candidate peaks comprises:

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assigning a largest power amplitude from said frequency domain data as a primary candidate peak;

assigning a next largest power amplitude that is not a harmonic of said primary candidate peak as a secondary candidate peak; and

assigning a previous non-zero pulse rate as a tertiary candidate peak if said previous non-zero pulse rate is neither said primary candidate peak nor said secondary candidate peak.

8. The method of claim 1, wherein said identifying said plurality of candidate peaks comprises identifying n peaks, by frequency, F_1 to F_n, in descending order of peak amplitude, where F_1 through F_n are not harmonics of each other.

9. The method of claim 1, further comprising filtering each of said plurality of candidate peaks with a narrow band filter before said developing parameters step.

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10. (Amended) The method of claim 9, wherein said narrow band filter comprises a finite impulse response filter.

11. (Amended) The method of claim 9, wherein said narrow band filter comprises an infinite impulse response filter.

12. The method of claim 1, further comprising filtering each of said plurality of candidate peaks with one of n narrow band filters before said developing parameters step to mask influence of candidate frequencies not under evaluation.

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13. The method of claim 12, wherein n = 8 and wherein each of said 8 narrow band filters is separated by a fixed difference in frequency in a range of approximately 25 bpm to approximately 30 bpm.

14. The method of claim 12, wherein each of said n narrow band filters is separated by a variable difference in frequency in a range of approximately 25 bpm to approximately 30 bpm.

15. The method of claim 1, further comprising filtering each of said plurality of candidate peaks with a narrow band filter of variable center frequency.

16. The method of claim 1, further comprising filtering each of said plurality of candidate peaks with a narrow band filter wherein filter coefficients are generated and adjusted so that the center frequency of said narrow band filter is approximately the frequency associated with each of said candidate peaks.

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17. The method of claim 1, further comprising filtering each of said plurality of candidate peaks using a fast Fourier transform (FFT), narrow band filter and inverse FFT.

18. The method of claim 1, wherein said analyzing each of said plurality of candidate peaks with respect to said developed parameters includes calculating a window pulse rate.

19. The method of claim 1, wherein said analyzing each of said plurality of candidate peaks with respect to said developed parameters includes calculating pulse width variability.

20. The method of claim 1, wherein said analyzing each of said plurality of candidate peaks with respect to said developed parameters includes calculating SpO_2 variability.

21. The method of claim 1, wherein said analyzing each of said plurality of candidate peaks with respect to said developed parameters includes calculating pulse window SpO_2.

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22. The method of claim 1, wherein said analyzing each of said plurality of candidate peaks with respect to said developed parameters includes calculating pulse rate history percentage.

23. The method of claim 1, wherein said analyzing each of said plurality of candidate peaks with respect to said developed parameters includes calculating pulse window confidence.

24. The method of claim 23, wherein said calculating pulse window confidence includes a weighted sum of pulse width variability, SpO_2 variability and pulse rate history percentage.

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25. The method of claim 1, wherein said analyzing each of said plurality of candidate peaks with respect to at least some of said developed parameters includes calculating a window pulse rate, pulse width variability, SpO_2 variability, pulse window SpO_2, pulse rate history percentage and pulse window confidence.

26. The method of claim 1, wherein said arbitrating between at least some of said plurality of candidate peaks based on said developed parameters includes applying a predetermined criteria to select said best frequency.

27. The method of claim 1, wherein said plurality of candidate peaks comprises up to three candidate peaks, including a primary candidate peak, a secondary candidate peak and a tertiary candidate peak.

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28. (Amended) The method of claim 27, wherein said arbitrating between each of said up to three candidate peaks includes applying the following criteria using at least some of said developed parameters to select said best frequency:

(a) if the primary candidate peak frequency is zero, then there is no valid candidate peak;

(b) if the tertiary candidate peak pulse window confidence is less than the pulse window confidence for either the primary candidate peak or the secondary candidate peak, then the tertiary candidate peak is said best frequency;

(c) if the primary candidate peak and the secondary candidate peak have both been rejected, then there is no valid candidate peak;

(d) if the primary candidate peak has not been rejected and the secondary candidate peak has been rejected, then the primary candidate peak is said best frequency;

(e) if the primary candidate peak has been rejected and the secondary candidate peak has not been rejected, then the secondary candidate peak is said best frequency;

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(f) if the primary candidate peak pulse window confidence is greater than the secondary candidate peak pulse window confidence by a first threshold, t_1, and the primary candidate peak pulse rate history percentage is greater than a second threshold, t_2, then the primary candidate peak is said best frequency;

(g) if the secondary candidate peak frequency is ~~a rough harmonic~~ of the primary candidate peak frequency and the pulse window confidence of the primary candidate peak is not more than a specified number of points greater than the pulse window confidence of the secondary candidate peak, then accept the primary candidate peak; and

(h) if the pulse window confidence of the primary candidate peak is no more than a specified number of points greater than the pulse window confidence of the secondary candidate peak, then said primary candidate peak is said best frequency, otherwise, said secondary candidate peak is said best frequency.

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29. The method of claim 28, wherein said arbitration is conducted in the sequence presented in claim 28.

30. (Amended) A method of determining pulse rate and saturation from electrical signals representative of attenuated light signals and motion artifacts, comprising:

acquiring a segment of red data and a segment of IR data from each of the electrical signals representative of attenuated light signals;

transforming both said segment of red data and said segment of IR data into red and IR frequency domain data, respectively;

identifying a plurality of candidate peaks from said red and IR frequency domain data, wherein said identifying includes eliminating harmonic frequencies as possible candidate peaks to obtain a plurality of identified candidate peaks, wherein no two of said plurality of identified candidate peaks comprise harmonics of one another;

developing parameters associated with each of said plurality of identified candidate peaks;

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analyzing each of said plurality of candidate peaks with respect to at least some of said developed parameters;

arbitrating between at least some of said plurality of candidate peaks employing at least some of said selected parameters to select a best frequency;

outputting pulse rate and saturation relating to said best frequency; and

repeating the above steps for new segments of data.

31. The method of claim 30, wherein said transforming includes performing a fast Fourier transform.

32. The method of claim 30, wherein said identifying said plurality of candidate peaks comprises:

assigning a largest power amplitude from said frequency domain data as a primary candidate peak;

assigning a next largest power amplitude that is not a harmonic of said primary candidate peak as a secondary candidate peak;

assigning a previous non-zero pulse rate as a tertiary candidate peak if said previous non-zero pulse rate is neither said primary candidate peak nor said secondary candidate peak.

33. The method of claim 30, wherein said developed parameters includes window pulse rate calculated by dividing sum of all pulse width times of all peaks in a data segment by quantity of peaks detected in said data segment.

34. The method of claim 30, wherein said developed parameters includes pulse width variability calculated as the sum of absolute differences between individual pulse widths and average pulse width normalized by said average pulse width.

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35. The method of claim 30, wherein said developed parameters includes SpO_2 variability calculated as a sum of absolute difference between individual SpO_2 values and average SpO_2 for a given pulse window.

36. The method of claim 30, wherein said developed parameters includes pulse window SpO_2 calculated by taking a measure of central tendency of all individual SpO_2 calculations in a given pulse window.

37. The method of claim 30, wherein said developed parameters includes pulse peak amplitude variability calculated as a sum of differences between individual pulse peak amplitudes and average pulse peak amplitude for a given pulse window.

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38. The method of claim 30, wherein said developed parameters includes pulse rate history percentage calculated as a percentage of time that a pulse rate corresponding to a candidate peak has occurred in a given period of time.

39. The method of claim 30, wherein said developed parameters includes pulse window confidence calculated as a weighted sum of pulse width variability, SpO_2 variability, pulse amplitude variability and pulse rate history percentage.

40. The method of claim 30, wherein said arbitrating between at least some of said plurality of candidate peaks employing at ~~lease~~ least some of said developed parameters includes applying selection criteria to select said best frequency.

41. (Amended) A method of removing motion artifacts from a single electrical signal representative of an attenuated light signal, comprising:

acquiring a segment of data from the electrical signal;

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conditioning said segment of data for signal processing;

transforming said conditioned segment of data into frequency domain data;

analyzing said frequency domain data to identify candidate peaks, wherein said analyzing includes eliminating harmonic frequencies as possible candidate peaks to obtain said candidate peaks, wherein no two of said candidate peaks comprise harmonics of one another;

developing parameters associated with each of said candidate peaks;

arbitrating between said candidate peaks using at least some of said developed parameters to select a best frequency; and

repeating the above steps with a new segment of data.

42. The method of claim 41, wherein said analyzing said frequency domain data to identify candidate peaks includes identifying all n candidate frequencies associated with the n largest amplitude peaks in power spectrum which are not harmonics of each other.

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43. The method of claim 42, wherein n equals two.

44. (Amended) A circuit card for use in a pulse oximetry system to remove motion-induced noise artifacts from attenuated light signals, said circuit card comprising:

a circuit board for mounting electronic circuitry and interfacing with the pulse oximetry system;

a processor mounted on said circuit board for processing at least one input signal according to instructions; and

memory for storing a computer program, wherein said memory is operably coupled to said processor, and wherein said computer program includes instructions for implementing a method of removing motion artifacts from said attenuated light signals, said method comprising:

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acquiring a segment of red data and a segment of IR data from said attenuated light signals;

conditioning said red segment of data and said IR segment of data for signal processing;

transforming said conditioned segments of data into frequency domain data;

analyzing said frequency domain data to identify candidate peaks, wherein said analyzing includes eliminating harmonic frequencies as possible candidate peaks to obtain said candidate peaks, wherein no two of said candidate peaks comprise harmonics of one another;

developing parameters associated with each of said candidate peaks;

arbitrating between said candidate peaks using at least some of said developed parameters to select a best frequency; and

repeating the above steps with a new segment of data.

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45. The circuit card of claim 44, wherein said processor is a digital signal processor.

46. (Amended) A pulse oximetry system for removing motion-induced noise artifacts from electrical signals representative of attenuated light signals comprising an input device, an output device, and a motion artifact circuit card, wherein said motion artifact circuit card comprises:

a circuit board for mounting electronic circuitry and interfacing with the pulse oximetry system;

a processor mounted on said circuit board for processing at least one input signal according to instructions; and

memory for storing a computer program, wherein said memory is operably coupled to said processor, and wherein said computer program includes instructions for implementing a method of removing motion artifacts from said measured pulse oximetry signals, said method comprising:

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acquiring a segment of red data and a segment of IR data from each of the electrical signals representative of attenuated light signals;

transforming both said segment of red data and said segment of IR data into red and IR frequency domain data, respectively;

identifying a plurality of candidate peaks from said red and IR frequency domain data, wherein said identifying includes eliminating harmonic frequencies as possible candidate peaks to obtain said plurality of candidate peaks, wherein no two of said plurality of candidate peaks comprise harmonics of one another;

developing parameters associated with each of said plurality of candidate peaks;

analyzing each of said plurality of candidate peaks with respect to said developed parameters;

arbitrating between at least some of said plurality of candidate peaks using at least some of said developed parameters to select a best frequency;

outputting pulse rate and saturation relating to said best frequency; and

repeating the above steps for new segments of data.

47. The pulse oximetry system of claim 46, wherein said processor is a digital signal processor.

48. (Amended) A pulse oximetry system for removing motion-induced noise artifacts from electrical signals representative of attenuated light signals comprising an input device, an output device, and a motion artifact circuitry, wherein said motion artifact circuitry includes:

a processor for processing at least one input signal according to instructions; and

memory operably coupled to said processor for storing a computer program, wherein said computer program includes instructions for implementing a method of removing motion artifacts from said measured pulse oximetry signal, wherein said method comprises:

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